Amendments to the Claims:

Claims 3-5, 7, and 9-11 are allowable, if rewritten. Other claim amendments have been made, as below. Newly added Claim 12 is also believed to be allowable.

Listing of Claims:

WHAT IS CLAIMED IS:

1. (Cancelled)

2. (Cancelled)

3. (Currently Amended) A process for producing polyethylene using a slurry loop reactor comprising:

using a mathematical model to predict a plurality of process control parameters based on ~~the~~ desired product properties and reactor characteristics and controlling the process using the predicted process control parameters~~.~~;

~~The process of Claim 1~~ wherein variables used to prepare the mathematical model include a plurality of variables selected from the group consisting of: ethylene flow into reactor, ethylene flow out of reactor, isobutane flow into reactor, isobutane flow out of reactor, hexene flow into reactor, hexene flow out of reactor, hexene conversion in reactor, hydrogen flow into reactor, hydrogen flow out of reactor, hydrogen conversion in reactor, polymer flow out of reactor, liquid flow out of reactor, total mass flow into reactor, total mass flow out of reactor, total volume flow out of reactor, catalyst flow into reactor, catalyst flow out of reactor, concentration of ethylene in the reactor liquid, concentration of hexene in the reactor liquid, concentration of hydrogen in the reactor liquid, temperature of reactor, pressure of reactor, weight concentration of solids in the reactor slurry, volume concentration of solids in the reactor slurry, weight concentration of solids in the settling leg solids bed, number of settling legs, reactor volume, settling leg diameter, settling leg height, bulk density of reactor polymer, density of reactor polymer, density of reactor, liquid, density of reactor slurry, residence time of reactor solids, catalyst activity, catalyst productivity, catalyst diameter, catalyst feed factor, catalyst activity factor, terminal velocity of settling polymer, polymer settling rate, rate of polymer leaving reactor that is not part of the settling leg solids bed, rate of slurry leaving reactor that is part of the settling leg solids bed, rate of slurry leaving reactor that is not part of the settling leg solids bed, viscosity of reactor liquid, density of catalyst, polymer diameter, Archimedes number for polymer settling in settling leg, Reynolds number for polymer settling in settling leg, acceleration due to gravity, cross sectional area of a settling leg occupied by polymer, and cross sectional area of a settling leg; and

~~The process of Claim 2~~ wherein the variables used to prepare the mathematical model are: polymer flow out of reactor, liquid flow out of reactor,

concentration of ethylene in the reactor liquid, temperature of reactor, pressure of reactor, weight concentration of solids in the reactor slurry, reactor volume, settling leg diameter, settling leg height, bulk density of reactor polymer, density of reactor polymer, and density of catalyst.

4. (Currently Amended) A process for producing polyethylene using a slurry loop reactor comprising:

using a mathematical model to predict a plurality of process control parameters based on ~~the~~ desired product properties and reactor characteristics and controlling the process using the predicted process control parameters~~.~~;

~~The process of Claim 1~~ wherein variables used to prepare the mathematical model include a plurality of variables selected from the group consisting of: ethylene flow into reactor, ethylene flow out of reactor, isobutane flow into reactor, isobutane flow out of reactor, hexene flow into reactor, hexene flow out of reactor, hexene conversion in reactor, hydrogen flow into reactor, hydrogen flow out of reactor, hydrogen conversion in reactor, polymer flow out of reactor, liquid flow out of reactor, total mass flow into reactor, total mass flow out of reactor, total volume flow out of reactor, catalyst flow into reactor, catalyst flow out of reactor, concentration of ethylene in the reactor liquid, concentration of hexene in the reactor liquid, concentration of hydrogen in the reactor liquid, temperature of reactor, pressure of reactor, weight concentration of solids in the reactor slurry, volume concentration of solids in the reactor slurry, weight concentration of solids in the settling leg solids bed, number of settling legs, reactor volume, settling leg diameter, settling leg height, bulk density of reactor polymer, density of reactor polymer, density of reactor, liquid, density of reactor slurry, residence time of reactor solids, catalyst activity, catalyst productivity, catalyst diameter, catalyst feed factor, catalyst activity factor, terminal velocity of settling polymer, polymer settling rate, rate of polymer leaving reactor that is not part of the settling leg solids bed, rate of slurry leaving reactor that is part of the settling leg solids bed, rate of slurry leaving reactor that is not part of the settling leg solids bed, viscosity of reactor liquid, density of catalyst, polymer diameter, Archimedes number for polymer settling in settling leg, Reynolds number for polymer settling in settling leg, acceleration due to gravity, cross sectional area of a settling leg occupied by polymer, and cross sectional area of a settling leg; and

~~The process of Claim 2~~ wherein the variables used to prepare the mathematical model are: polymer flow out of reactor, liquid flow out of reactor,

concentration of ethylene in the reactor liquid, temperature of reactor, pressure of reactor, weight concentration of solids in the reactor slurry, reactor volume, settling leg diameter, settling leg height, bulk density of reactor polymer, density of reactor polymer, density of catalyst, concentration of hexene in the reactor liquid, concentration of hydrogen in the reactor liquid, hexene conversion in reactor, and hydrogen conversion in reactor.

5. (Currently Amended) A process for producing polyethylene using a slurry loop reactor comprising:

using a mathematical model to predict a plurality of process control parameters based on ~~the~~ desired product properties and reactor characteristics; and controlling the process using the predicted process control parameters~~.~~; and

~~The process of Claim 1~~ wherein the process is controlled using the mathematical model which has been incorporated into a computer spreadsheet.

6. (Cancelled).

7. (Currently Amended) A process for producing polyethylene using a slurry loop reactor comprising~~.~~:

using a mathematical model to predict a plurality of process control parameters based on ~~the~~ desired product properties and reactor characteristics and controlling the process using the predicted process control parameters;

~~The process of Claim 1~~ wherein the process is controlled using the mathematical model which has been incorporated into a controller; and

~~The process of Claim 6~~ wherein the controller is a neural network model based controller.

8. (Cancelled).

9. (Currently Amended) A controller for an industrial slurry loop reactor used to produce ~~high-density polyethylene~~ a polymer comprising a controller programmed with an algorithm to control the slurry loop reactor using a mathematical model to predict a plurality of process control parameters based on ~~the~~ desired product properties and reactor characteristics and controlling the process using the predicted process control parameters; and

~~The controller of Claim 9~~ 8 wherein the controller is a neural network model based controller.

10. (Currently Amended) A process for ~~optimizing the~~ designing a configuration of a ~~polyethylene~~ polymer loop reactor comprising:

using a ~~the~~ model ~~of Claim 1~~ to design the reactor, comprising ~~A~~a process for producing polyethylene a polymer using a slurry loop reactor comprising using a mathematical model to predict a plurality of process control parameters based on ~~the~~ desired product properties and reactor characteristics; and

controlling the process using the predicted process control parameters.

11. (Cancelled)

12. (New) A process for designing a configuration of a slurry loop reactor used to produce polymers comprising:

using a mathematical model to predict a plurality of process control parameters based on desired product properties and reactor characteristics and controlling the process using the predicted process control parameters, where variables used to prepare the mathematical model have a variability decreased by 70% in comparison to a conventional PID controller.